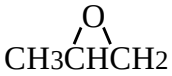
PROPYLENE OXIDE

Propylene oxide is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 75-56-9

Molecular Formula: C_3H_6O



Propylene oxide is a colorless, flammable, liquid with a sweet, alcoholic odor. It is soluble in water and miscible with acetone, alcohol, benzene, and ether. It can react vigorously with oxidizing materials and is an explosion hazard when exposed to heat or flame. (HSDB, 1991).

Physical Properties of Propylene Oxide

Synonyms:	1,2-epoxypropane; 1,2-propylene oxide; methyloxirane; propene oxide; methyl ethylene oxide; propylene epoxide
Molecular Weight:	58.08
Boiling Point:	34.23 °C
Melting Point:	-112.13 °C
Flash Point:	Closed cup: -31 °F (-35 °C)
Vapor Pressure:	532.1 mm Hg at 25 °C
Density/Specific Gravity:	0.83043 at 20/20 °C (water = 1)
Log/Octanol Water Partition Coefficient:	0.03
Water Solubility:	476,000 mg/kg at 25 °C
Henry's Law Constant:	8.54×10^{-5} atm-m^3/mole
Vapor Density:	2.0 (air = 1)
Conversion Factor:	1 ppm = 2.38 mg/m^3

(HSDB, 1991; Sax, 1989; Howard, 1990; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Propylene oxide is used as a chemical intermediate in the synthesis of polyurethane polyols for the production of polyurethane foams, coatings, and adhesives; in the manufacture of propylene glycol for use in fiberglass-reinforced plastics, in foods, cosmetics, pharmaceuticals, cigarette tobacco, packaging materials, dyes, and hydraulic fluids; in the preparation of glycol ethers, dipropylene glycol, industrial polyglycols, lubricants, surfactants, oil demulsifiers, and

isopropanolamines; and as a solvent and soil sterilant (NTP, 1991). Propylene oxide has been detected but not quantified in automobile exhaust and other combustion sources that burn hydrocarbons (HSDB, 1991).

Propylene oxide is registered as a bactericide, fungicide, and insecticide. It is used for post harvest fumigation of fruit and nut crops, flavoring and spice crops, and processed food and feed. It is for use in airtight sterilization chambers. The licensing and regulation of pesticides for sale and use in California are the responsibility of the Department of Pesticide Regulation (DPR). Information presented in this fact sheet regarding the permitted pesticidal uses of propylene oxide has been collected from pesticide labels registered for use in California and from DPR's pesticide databases. This information reflects pesticide use and permitted uses in California as of October 15, 1996. For further information regarding the pesticidal uses of this compound, please contact the Pesticide Registration Branch of DPR (DPR, 1996).

The primary stationary sources that have reported emissions of propylene oxide in California are manufacturers/producers of industrial organic chemicals, wholesale grocery trade and related products, and manufacture of miscellaneous plastics (ARB, 1997b).

B. Emissions

The total emissions of propylene oxide from stationary sources in California are estimated to be at least 750,000 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of propylene oxide was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of propylene oxide.

INDOOR SOURCES AND CONCENTRATIONS

Propylene Oxide is found in several consumer product categories including gasket and tire cleaners, wood finishes, adhesives, spray shoe polishes, and spray paints (Hodgson and Wooley, 1991). During a pilot study in Woodland, California, neither of the four homes monitored had concentrations of propylene oxide greater than the 0.13 parts per billion by volume detection limit (Sheldon and Jenkins, 1990).

ATMOSPHERIC PERSISTENCE

Propylene oxide exists in the atmosphere in the gas phase. The dominant chemical atmospheric loss process for propylene oxide is by reaction with the hydroxyl (OH) radical. Based on this reaction, the atmospheric half-life and lifetime of propylene oxide is estimated to be 19 days and 28 days, respectively (Atkinson, 1989). Experimental products studies have not been carried out to date (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of April 1996, propylene oxide represented the principal cancer risk in 5 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million, and contributed to the total cancer risk in 18 of these risk assessments. Propylene oxide also represented the principal cancer risk in 1 of the approximately 130 risk assessments reporting a total cancer risk equal to or greater than 10 in 1 million, and contributed to the total cancer risk in 7 of these risk assessments (OEHHA, 1996a).

For non-cancer health effects, propylene oxide contributed to the total hazard index in 8 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Propylene oxide also contributed to the total hazard index in 4 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1, and also presented an individual hazard index greater than 1 in 3 of these risk assessments (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to propylene oxide are inhalation and dermal contact.

Non-Cancer: Propylene oxide is a severe irritant of the eyes and respiratory tract. It is also a mild central nervous system depressant. Acute inhalation exposure may result in signs and symptoms including headache, motor weakness, incoordination, and coma. Respiratory symptoms, which may be delayed, include coughing, difficulty in breathing, and pulmonary edema. Neurotoxicity has been reported in animal studies (U.S. EPA, 1994a).

An acute non-cancer Reference Exposure Level (REL) of 1,000 micrograms per cubic meter ($\mu g/m^3$) and a chronic REL of 30 $\mu g/m^3$ are listed in for propylene oxide in the California Air Pollution Control Officers Association (CAPCOA) Revised 1992 Risk Assessment Guidelines. The toxicological target considered for acute toxicity is the central nervous system. The toxicological endpoints considered for chronic toxicity are the central/peripheral nervous systems, kidney, gastrointestinal system, liver, reproductive, and respiratory systems (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) has established a Reference Concentration (RfC) for propylene oxide of 30 $\mu g/m^3$ based on nasal effects in rats. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The U.S. EPA has not

established an oral Reference Dose (RfD) (U.S. EPA, 1994a).

No information is available on adverse reproductive function effects in humans; however, evidence exists for fetotoxicity in animals (U.S. EPA, 1994a).

Cancer: Inadequate data exist regarding human carcinogenicity of propylene oxide. There is evidence for increased incidence of tumors in test animals. The U.S. EPA has classified propylene oxide as Group B2: Probable human carcinogen with an inhalation unit risk estimate of 3.7×10^{-6} (microgram per cubic meter)$^{-1}$. The U.S. EPA estimates that if a person were to breathe air containing propylene oxide at 0.3 $\mu g/m^3$ over an entire lifetime, that person would theoretically have no more than a 1 in a million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified propylene oxide as Group 2B: Possible human carcinogen, based on sufficient evidence in animals (IARC, 1994b).

The State of California has determined under Proposition 65 that propylene oxide is a carcinogen (CCR, 1996). The recommended potency value for use in cancer risk assessments is 3.7×10^{-6} (microgram per cubic meter)$^{-1}$. In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu g/m^3$ of propylene oxide is estimated to be no greater than 3.7 in 1 million (CAPCOA, 1993).